

$^{11}\text{B}(^3\text{He}, ^{12}\text{C})$ [2010Ki08,2012Ki07](#)

Type	Author	History	Citation	Literature Cutoff Date
Full Evaluation	J. H. Kelley, J. E. Purcell and C. G. Sheu		NP A968, 71 (2017)	1-Jan-2017

[2009Ki13](#): $^{11}\text{B}(^3\text{He}, \text{d})$ $E=8.5$ MeV, measured E_p , I_p , E_α , I_α in complete kinematics. ^{12}C deduced γ -ray and α -decay branching ratios from high energy levels, B(M1).

[2010Ki08](#): XUNDL dataset compiled by TUNL, 2010.

The $^{12}\text{C}^*(9.6, 10.8, 11.8, 12.7, 13.3 \text{ MeV})$ 3α breakup states were populated at $E(^3\text{He})=8.5$ MeV at the Centro de Microanálisis de Materiales in Madrid. The 3α ejectiles were detected in an array of position sensitive ΔE -E detectors that covering 38% of 4π . The excitation energies of residual ^{12}C nuclei were determined by complete reconstruction of the $3\alpha + \text{d}$ ejectiles. For sequential decays involving ^8Be , the participation of $^8\text{Be}^*(0, 3.04 \text{ MeV})$ were resolved.

A Dalitz plot analysis was used to evaluate the spin and parity of participating resonances. Discussion on Sequential vs Democratic (Direct) breakup processes is given.

[2012Ki07](#): XUNDL dataset compiled by TUNL, 2012.

The 3α -particle correlations following $^{12}\text{C}^*$ breakup in search of support for direct 3-body breakup of $^{12}\text{C}^*(7.65 \text{ MeV})$ as suggested by ([2011Ra34](#)). Significant discussion is given on the astrophysical impact of modifications to the 3α reaction rate as suggested by ([2011Ra34](#)). Also see ([2012Ma10](#)).

The complete reaction kinematics were determined at $E(^3\text{He})=8.5$ MeV by coincidence measurement of the recoiling deuteron and the breakup α -particles in an array of four position sensitive ΔE -E telescopes. Analysis of the deuteron momentum indicates $^{12}\text{C}^*(7.65, 9.6, 10.8, 11.8, 12.7)$ groups. The $\text{d}+3\alpha$ multiplicity=4 events corresponding to $^{12}\text{C}^*(7.65 \text{ MeV})$ were analyzed via Dalitz plot analysis of the α -particle correlations; The analysis employed "kinematic fitting", which constrains the event-by-event data to rigorously conserve energy and momentum for the Hoyle state breakup events.

No definite evidence for breakup other than sequential breakup via $^{12}\text{C}^*(7.65 \text{ MeV}) \rightarrow \alpha + ^8\text{Be}_{\text{g.s.}}$ is observed. Limits of: direct breakup into 3 equal energy α -particles (DDE) $<0.9 \times 10^{-3}$; direct breakup into one α -particle at rest with 2 equal energy α -particles (DDL) $<0.9 \times 10^{-3}$, and decay into 3-body phase space (DD Φ) $<5 \times 10^{-3}$ are deduced.

 ^{12}C Levels

E(level) [†]	J ^π [†]	Γ [†]	Comments
7654.	0 ⁺	9.3 eV	Decay is consistent with 100% decay to $\alpha + ^8\text{Be}_{\text{g.s.}}$. (2012Ki07) determine upper limit of 0.005 for direct α decay branches bypassing the ground state of ^8Be .
9641	3 ⁻	46 keV	
10844	1 ⁻	273 keV	
11828	2 ⁻	230 keV	
12710	1 ⁺	18.1 eV	
13.35×10^3	4 ⁻	360 keV	

[†] From Adopted Levels.